NL 030704
IB/2004/050978

Europäisches Patentamt
European Patent Office
Office européen des brevets

Bescheinigung Certificate Attestation

Die angehefteten Unterlagen stimmen mit der ursprünglich eingereichten Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.

The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr. Patent application No. Demande de brevet n°

03101927.6

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

R C van Dijk

Anmeldung Nr:
Application no.: 03101927.6 ✓
Demande no:

Anmeldetag:
Date of filing: 27.06.03 ✓
Date de dépôt:

Anmelder/Applicant(s)/Demandeur(s):

Koninklijke Philips Electronics N.V.
Groenewoudseweg 1
5621 BA Eindhoven
PAYS-BAS

Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
Si aucun titre n'est indiqué se referer à la description.)

Pickup unit homing mechanism for a disk drive unit

In Anspruch genommene Priorität(en) / Priority(ies) claimed /Priorité(s) revendiquée(s)
Staat/Tag/Aktenzeichen/State/Date/File no./Pays/Date/Numéro de dépôt:

Internationale Patentklassifikation/International Patent Classification/
Classification internationale des brevets:

G11B7/00

Am Anmeldetag benannte Vertragstaaten/Contracting states designated at date of filing/Etats contractants désignées lors du dépôt:

AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LU MC NL
PT RO SE SI SK TR LI

Pickup unit homing mechanism for a disk drive unit

The invention relates to a disk drive unit for a disk.

Disk drive units of this type are known in many embodiments thereof, and generally comprise a mounting plate, a spindle motor assembly, a pickup unit for reading and/or writing data on the disk, and a sledge mechanism which is adapted to move the pickup unit along the surface of the disk between a homing position and a read and/or write position. In general the sledge is moved by a transmission assembly comprising a gear rack operatively coupled with the sledge and in engagement with a gear wheel which is driven by a DC motor. In order to detect the homing position of the pickup unit, disk drive units of this type generally comprise an additional limit switch which is adapted to stop the DC motor when the homing position is reached. However, the application of a limit switch within a disk drive unit leads to additional assembly and material costs, which comprise in general the costs for a switch, some resistors and connectors, an I/O port and additional space on the circuit board.

It is an object of the invention to provide a disk drive unit for a disk wherein the above-mentioned additonal limit switch is not needed.

In order to accomplish that objective, the disk drive unit according to the invention comprises a pickup unit mounted to a sledge of a sledge mechanism, which sledge mechanism is adapted to move the pickup unit along the disk between a homing position and a read and/or write position, the sledge mechanism comprising a driven first transmission member which is operatively connected to the sledge for moving the sledge, and a driving second transmission member which is only in engagement with the first transmission member when the pickup unit is in the read and/or write position, and wherein the pickup unit and the second transmission member comprise engagement members which are adapted to come into engagement at least when the second transmission memberis not in engagement with the first transmission member so as to move the pickup unit away from the homing position, which movement causes the first and second transmission members to engage.

In the disk drive unit according to the invention, the first and second transmission member are disengaged when the pickup unit reaches its homing position, whereby the movement of the pickup unit is stopped. In other words, the transmission assembly of the disk drive unit is adapted to stop the movement of the sledge when the pickup unit reaches its homing position, whereby a limit switch is no longer necessary to detect the homing position of the pickup unit, which is cost effective. In order to bring the first and second transmission members back in engagement, the invention provides engagement members at the second transmission member and the pickup unit.

The features as defined in claim 2 have the advantage that the engagement members of the pickup unit and the second transmission member do not interfere with the movement of the pickup unit when it is moved to its homing position.

The feature as defined in claim 3 has the advantage that a cam is a very simple and low-cost means to initiate the engagement of the engagement members of the pickup unit and the second transmission member. Moreover, as a movable bearing plate coupled to the actuator of the pickup unit is generally used in disk drive units, the addition of the cam is the only change to be made to the bearing plate in order to obtain the disk drive unit according to the invention, which is cost effective.

The features as defined in claims 4 to 6 have the advantage that a gear rack and a gear wheel having a protrusion are simple to manufacture.

The features as defined in claims 7 and 8 have the advantage that the movement of the pickup unit away from its homing position is controlled by a control unit which is already applied within the disk drive unit.

The features as defined in claims 9 to 11 have the advantage that the engagement of the first and second transmission member is detected by the detection of the surface of the disk, whereby no additional detecting members are necessary to detect the engagement of the transmission members, which is cost effective.

The invention also relates to a device for reading and/or writing information, such as data, from/on an optical disk. The device according to the invention is provided with the disk drive unit according to the invention.

These and other aspects and advantages of the invention will be apparent from the following description with reference to the drawings.

Fig. 1 is a perspective top view of a preferred embodiment of the disk drive unit according to the invention.

Fig. 2 is a perspective bottom view of the disk drive unit of Fig. 1;

Fig. 3 is a perspective view of the first transmission member of the disk drive unit as shown in Fig. 2, on a larger scale; and

Fig. 4 is a perspective view of the second transmission member of the disk drive unit as shown in Fig. 2, on a larger scale.

The drawings show a preferred embodiment of the disk drive unit according to the invention. This disk drive unit 1 may be used in a device for reading and/or writing data on a disk, such as a compact disk player, which is adapted to read and/or write compact disks for audio and/or video by means of an optical or magnetical reading and/or writing member.

With reference to Fig. 1 and 2, the preferred embodiment of the disk drive unit comprises a mounting plate 2 and a spindle motor assembly 3 on the mounting plate which is adapted to support and to rotate a disk when positioned on the spindle motor assembly 3. In order to read and/or write the data on the disk, a pickup unit 4 is provided which comprises a laser assembly 5. In operation, the disk is rotated and the laser assembly 5 is translated along the disk in a radial direction with respect to the disk. The focussing of the laser assembly 5 in a normal direction with respect to the disk is performed by a focus actuator mechanism within the laser assembly (not shown). The movement of the laser assembly in a radial direction along and with respect to the disk is performed by a sledge mechanism 6 which roughly positions the pickup unit with respect to the disk and by a positioning mechanism 7 of the pickup unit 4 which performs the fine positioning of the laser assembly 5.

With reference to Fig. 2, the sledge mechanism 6 of the preferred embodiment of the disk drive unit 1 comprises a sledge 8, wherein the pickup unit 4 is mounted on the sledge 8. The positioning mechanism 7 of the pickup unit 4 comprises a bearing plate 9 which is pivotably mounted to the sledge 8 by means of a pivot pin 10. The positioning mechanism 7 further comprises an actuator 11 which is operatively connected to the bearing plate 9 and the sledge 8. The actuator 11 is adapted to rotate the bearing plate 9 around the pivot pin 10 with respect to the sledge 8. The laser assembly 5 is mounted to the bearing plate 9 at a distance from the pivot pin 10 such that the laser assembly 5 is slightly moved along the disk due to the rotation of the bearing plate 9.

The sledge mechanism 6 of the preferred embodiment of the disk drive unit 1 is adapted to move the pickup unit 4 to a homing position, which is near the spindle motor assembly 3 as shown in Fig. 1 and 2, and an operating position where the laser assembly 5 of the pickup unit 4 is enabled to read and/or write the data on the disk. The homing position of the pickup unit 4 is the starting point from which a read and/or write sequence of the disk is started.

With reference to Fig. 2, the sledge mechanism 6 comprises a first and a second transmission member, wherein the first transmission member is a gear rack 12 mounted to the sledge 8 and the second transmission member is a gear wheel 13 rotatably mounted to the mounting plate 2. The gear rack 12 is adapted to come into engagement with the gear wheel 13. When the gear wheel 13 and the gear rack 12 are engaged, the rotation of the gear wheel 13 leads to a displacement of the sledge 8. As shown in Fig. 2, the preferred embodiment of the disk drive unit 1 comprises a DC motor 14 which is adapted to rotate the gear wheel 13 by means of a series of gearwheels 15.

The gear rack 12 of the preferred embodiment of the disk drive unit 1 is shown in more detail in Fig 3. As shown, the gear rack 12 is formed on a mounting member 16 in order to be mounted to the sledge 8. The mounting member 16 further comprises a free-running section 17 provided at one end of the mounting member 16. The gear rack 12 is positioned at the mounting member 16 such that the gear wheel 13 is in engagement with the gear rack 12 when the pickup unit is in its read and/or write position and such that the gear wheel 13 is positioned at the free-running section 17 when the pickup unit 4 is in its homing position. For the proper functioning of the sledge mechanism 6, the free-running section 17 is not strictly required and the part containing the free-running section may therefore be omitted so that the gear rack is just shorter. The sledge mechanism 6 will work properly when the gear wheel 13 and the gear rack 12 are disengaged when the pickup unit 4 is in its homing position due to the limited length and the position of the gear rack 12 with respect to the sledge 8 and the gear wheel 13.

As shown in Fig. 2, the bearing plate 9 of the pickup unit 4 of the preferred embodiment of the disk drive unit 1 comprises a cam 18 as an engagement member. As the bearing plate 9 is rotatable due to the action of the actuator 11 of the pickup unit 4, the cam 18 is movable due to the action of the actuator 11 too.

As shown in Fig. 2 and 4, the gear wheel 13 of the preferred embodiment of the disk drive unit 1 is provided with a protrusion 19 as an engagement member. The protrusion 19 is positioned such, that it is enabled to come into engagement with the cam 18

of the pickup unit 4 only when the actuator 11 has moved the cam 18 towards the gear wheel 13 by rotating the bearing plate 9. As a result, the cam 18 and the protrusion 19 do not interfere with the movements of the pickup unit 4 when the pickup unit 4 is moved to its homing position.

The preferred embodiment of the disk drive unit 1 further comprises a control unit (not shown) which is connected to the spindle motor assembly 3, to the laser assembly 5, to the actuator 11 and to the DC motor 14 (by means of electric conductors, not shown). The control unit is adapted to power and control at least the above mentioned electric members.

With reference to Fig. 2, the working of the sledge mechanism 6 of the preferred embodiment of the disk drive unit is as follows:

After reading and/or writing of the data on the disk, the control unit applies a constant voltage to the DC motor 14 of the sledge mechanism 6 during a fixed time period. The voltage is provided such that the gear wheel 13 is rotated in the direction as indicated by arrow 20. As the gear rack 12 and the gear wheel 13 are in engagement, the pickup unit 4 mounted on the sledge 8 is translated towards its homing position. When the homing position is reached, the gear rack 12 and the gear wheel 13 are disengaged due to the limited length and the position of the gear rack 12 with respect to the sledge 8 and the gear wheel 13, whereby the movement of the pickup unit 4 is stopped and the gear wheel 13 is enabled to rotate freely around its axis at the position of the free-running section 17 on the mounting member 16. The fixed time period of the voltage applied to the DC motor 14 of the sledge mechanism 6 is based on the time which is needed to move the pickup unit 4 from its outermost position towards its homing position. As the gear rack 12 and the gear wheel 13 are disengaged when the pickup unit 4 reaches its homing position, any remaining rotations of the gear wheel 13 in the case the pickup unit 4 is not moved from its outermost position will not have any impact on the sledge mechanism 6.

A start-up procedure is started when the fixed time period has passed and a new read and/or write sequence is desired. This start-up procedure is necessary to bring the gear rack 12 and the gear wheel 13 back into engagement in order to enable the laser assembly 5 of the pickup unit 4 to read and/or write the data on the disk.

In the start-up procedure, the control unit powers the actuator 11 of the pickup unit 4 such, that the cam 18 of the pickup unit 4 is brought in a position where it is enabled to come into engagement with the protrusion 19 on the gear wheel 13.

In the start-up procedure, the control unit also causes a series of voltage pulses to be applied to the DC motor 14 of the sledge mechanism 6 such that the gear wheel 13

rotates stepwise in a direction opposite to arrow 20. The duration of each voltage pulse is such, that the gear wheel 13 makes approximately half a revolution per voltage pulse. Thus, when the gear wheel 13 is rotated, the protrusion 19 on the gear wheel 13 will hit the cam 18 of the pickup unit 4 and as a result, the pickup unit 4 is moved away from its homing position. This movement of the pickup unit 4 causes the gear rack 12 and the gear wheel 13 to engage.

During the start-up procedure, the control unit also starts focussing of the laser assembly 5. During focussing, which is also performed during the reading and/or writing of the data on the disk, the laser assembly 5 is turned on in order to detect the information area of the disk. After each voltage pulse applied to the DC motor 14 of the sledge mechanism 6, the control unit determines whether the laser assembly 5 has detected the information area of the disk. When during the start-up procedure the information area of the disk is detected by the laser assembly 5, the gear rack 12 and the gear wheel 13 must be properly engaged and the start-up procedure is stopped. In general, the gear rack 12 and the gear wheel 13 will come into engagement within two or three half rotations of the gear wheel 13. In order to prevent a time consuming start-up procedure when no disk is placed within the disk drive unit or when the laser assembly 5 is unable to detect any information area on the disk, the sequence of applied voltage pulses is limited, preferably to six pulses.

As is clear from the above description, the engagement of the gear rack 12 and the gear wheel 13 is detected by the laser assembly 5 of the pickup unit 4, so that the pickup unit 4 is able to function as a detecting member, without the need for an additional component.

From the above description it should be understood that the movement of the pickup unit 4 is advantageously stopped at its homing position due to the limited length and the position of the gear rack 12 with respect to the sledge 8 and the gear wheel 13, and that the pickup unit 4 is moved away from its homing position by the cam 18 on the pickup unit 4 and the protrusion 19 on the gear wheel 13 and by the action of the actuator 11 of the pickup unit 4, wherein the control unit powers and controls the rotation of the gear wheel 13 and the action of the actuator 11. As a result, a limit switch for the detection of the homing position of the pickup unit 4 is not required, which leads to a saving of manufacturing costs of the disk drive unit 1.

As the gear rack 12, the gear wheel 13 provided with the protrusion 19, and the cam 18 provided on the pickup unit 4 are very simple to manufacture, the manufacturing costs of these means are relatively low.

The invention is not restricted to the above-described examples as shown in the drawing, which can be varied in several ways without departing from the scope of the invention.

For example, it should be understood that the engagement member of the pickup unit is not limited to a cam and that the engagement member of the second transmission member is not limited to a protrusion provided on the second transmission member. The engagement members may be any kind of cooperating members, such as brushes or the like, as long as the pickup unit is pushed away from its homing position by the movement of the second transmission member.

As a further example it should be understood that the first and second transmission members are not limited to a gear wheel and a gear rack. Any set of transmission members may be provided, such as a running surface driven by a wheel or gear wheels comprising free running sections and operatively connected to the pickup unit in order to move the pickup unit.

In general it is noted that, in this application, the expression "comprising" does not exclude other elements, and "a" or "an" does not exclude a plurality. A single processor or unit may fulfil the functions of several elements in the appended claims. Reference signs in the claims shall not be construed as limiting the scope thereof.

CLAIMS:

1. Disk drive unit (1) for a disk, which disk drive unit (1) comprises a pickup unit (4) mounted to a sledge (8) of a sledge mechanism (6), which sledge mechanism (6) is adapted to move the pickup unit (4) along the disk between a homing position and a read and/or write position, the sledge mechanism (6) comprising a driven first transmission member (12) which is operatively connected to the sledge (8) for moving the sledge (8), and a driving second transmission member (13) which is only in engagement with the first transmission member (12) when the pickup unit (4) is in the read and/or write position, and wherein the pickup unit (4) and the second transmission member (13) comprise engagement members (18, 19) which are adapted to come into engagement at least when the second transmission member (13) is not in engagement with the first transmission member (12) so as to move the pickup unit (4) away from the homing position, which movement causes the first and second transmission members (12, 13) to engage.

2. Disk drive unit (1) according to claim 1, wherein the engagement member (18) of the pickup unit (4) is operatively coupled to an actuator (11) of the pickup unit (4), and wherein the engagement member (18) of the pickup unit (4) is adapted to come into engagement with the engagement member (19) of the second transmission member (13) due to the action of the actuator (11) of the pickup unit (4).

3. Disk drive unit (1) according to claim 2, wherein the engagement member of the pickup unit is a cam (18) at a bearing plate (9) of the pickup unit (4), which bearing plate (9) is operatively coupled to the actuator (11) of the pickup unit (4), and movable, preferably rotatable around a pivoting pin (10), under the action of the actuator (11) of the pickup unit (4) in order to move the cam (18) to a position in which it is enabled to come into engagement with the engagement member (19) of the second transmission member (13).

4. Disk drive unit (1) according to any one of the preceding claims, wherein the second transmission member (13) is a gear wheel (13).

5. Disk drive unit (1) according to any one of the preceding claims, wherein the engagement member (19) of the second transmission member (13) is a protrusion (19) provided on the second transmission member (13) in such position that it is enabled to come into engagement with the engagement member (18) of the pickup unit (4).

6. Disk drive unit (1) according to claim 4 or 5, wherein the first transmission member (12) is a gear rack (12) which is positioned such that the gear rack (12) is in engagement with the gear wheel (13) when the pickup unit (4) is in its read and/or write position, and such that the gear rack (12) is out of engagement with the gear wheel (13) when the pickup unit (4) is in its homing position.

7. Disk drive unit (1) according to any one of claims 3 to 6, wherein the engagement of the engagement members (18, 19) of the pickup unit (4) and the second transmission member (13) is caused by a movement of the second transmission member (13) and the simultaneous movement of the engagement member (18) of the pickup unit (4) to the position where it is enabled to come into engagement with the engagement member (19) of the second transmission member (13).

8. Disk drive unit (1) according to any one of the preceding claims, comprising a control unit being programmed such that the drive of the second transmission member (13) exists of a sequence of stepped driving movements, which sequence is stopped when the first and second transmission members (12, 13) are in engagement, or when a preset amount of driving movements is reached.

9. Disk drive unit (1) according to any one of the preceding claims, wherein the engagement of the first and second transmission members (12, 13) is detected by a detecting member.

10. Disk drive unit (1) according tot claim 9, wherein the detecting member is formed by the pickup unit (4).

11. Disk drive unit (1) according to claim 10, wherein the control unit is programmed such that the driving movements of the second transmission member (13) is

stopped when the pickup unit (4) detects the engagement of the first and second transmission members (12, 13) by detecting a surface of a disk which is placed in the disk drive unit (1).

12. Disk drive unit (1) according to any one of the preceding claims, wherein the second transmission member (13) is operatively connected to a motor (14) for driving the second transmission member (13).

13. A device for reading and/or writing information from/on an optical disk, provided with the disk drive unit as claimed in any of the preceding Claims.

ABSTRACT:

A disk drive unit (1) for a disk, comprising a mounting plate (2), a spindle motor assembly (3), a sledge mechanism (6) provided with a sledge (8), a pickup unit (4) mounted on the sledge (8), a first transmission member (12) operatively connected with the sledge (8), and a second transmission member (13), wherein the first transmission member (12) is positioned such that it is in engagement with the second transmission member (13) when the pickup unit (4) is in its read and/or write position and such that the first transmission member (12) is out of engagement with the second transmission member(13) when the pickup unit (4) is in its homing position. In order to bring the first and second transmission members (12, 13) in engagement, the transmission members are provided with engagement members (18, 19). As a result, a limit switch assembly is no longer necessary.

(Fig. 2)

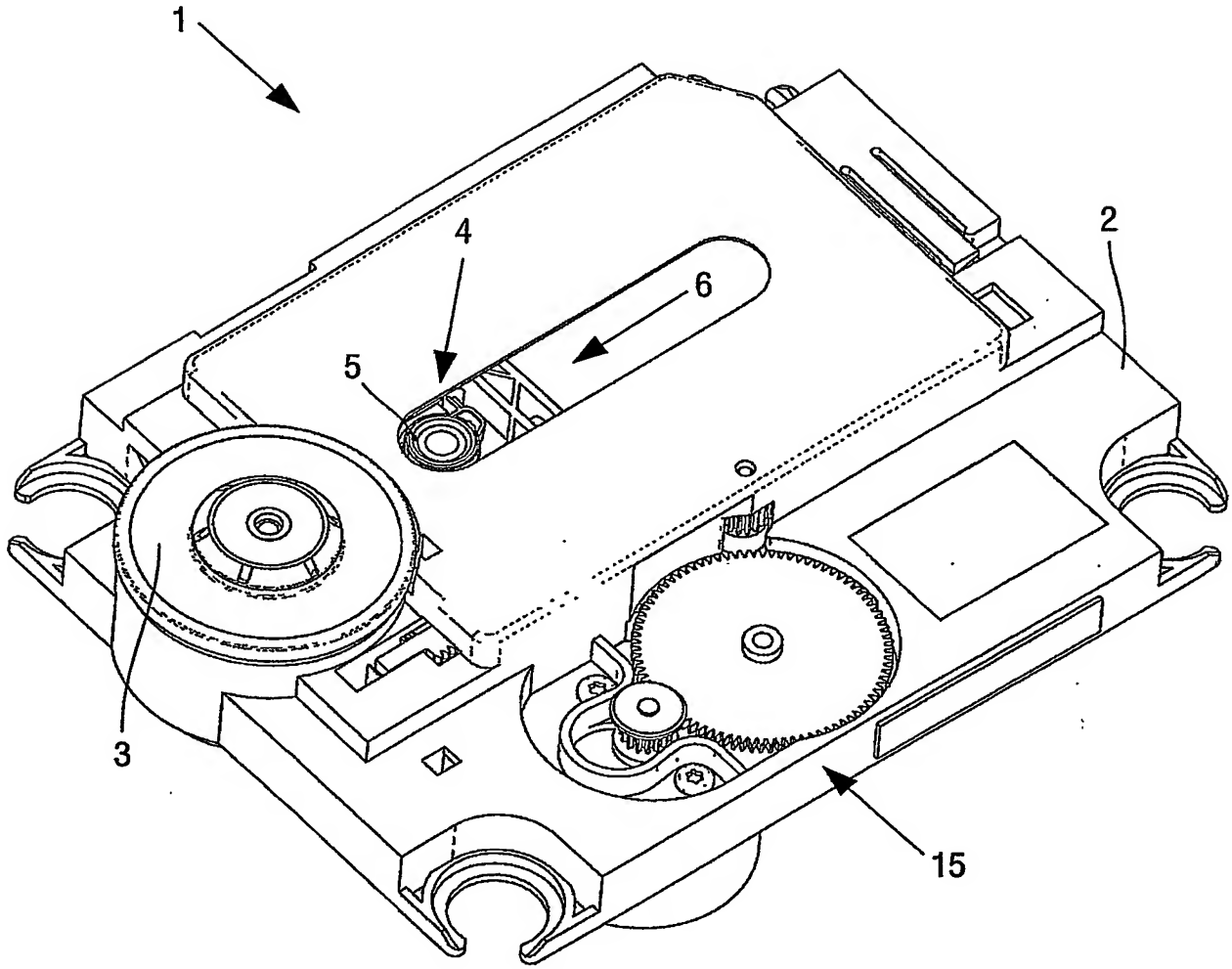

FIG.1

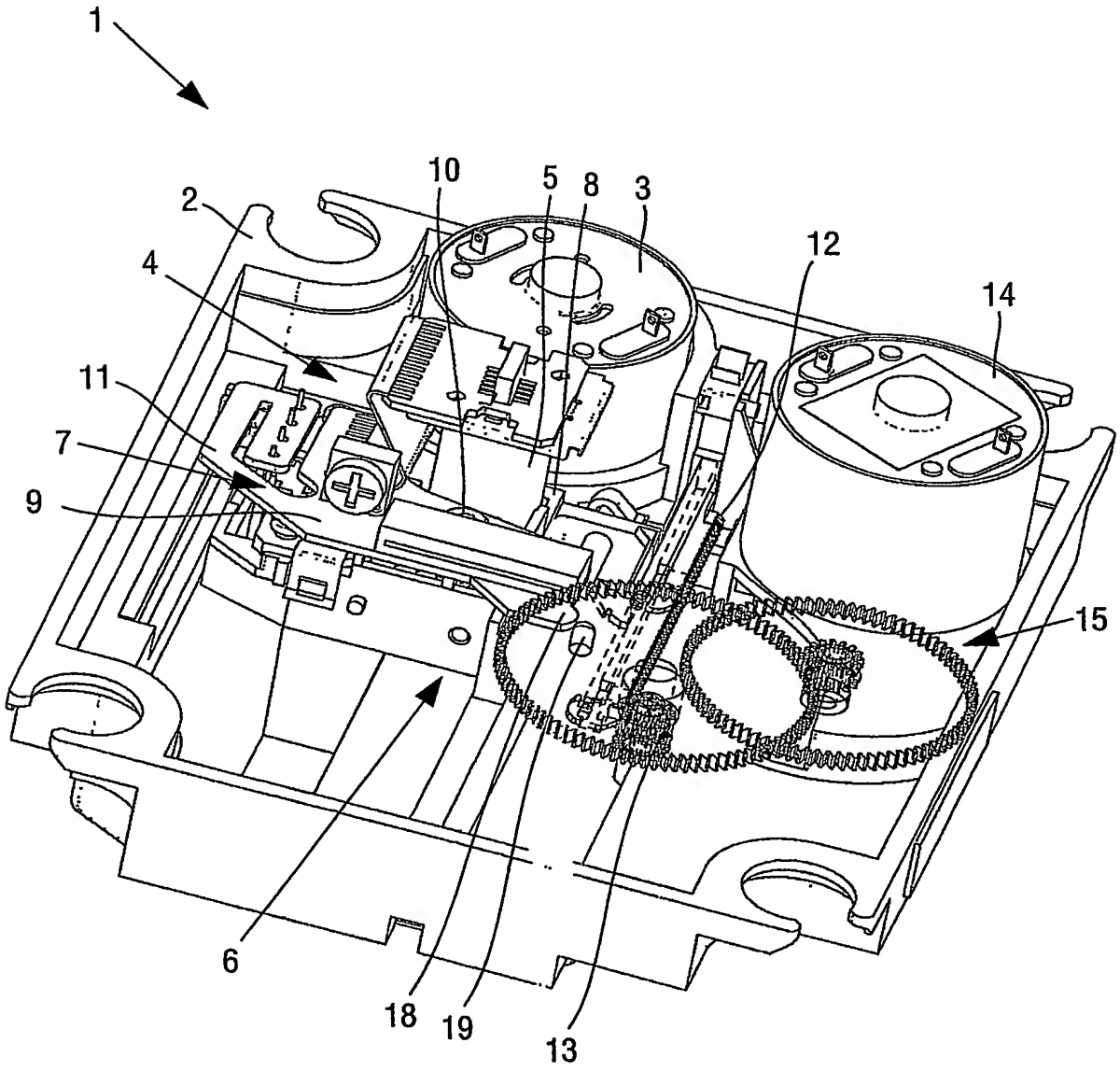

FIG.2

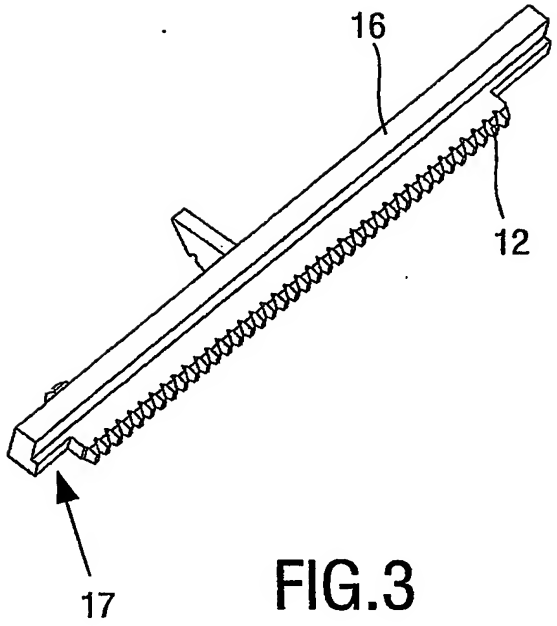

FIG.3

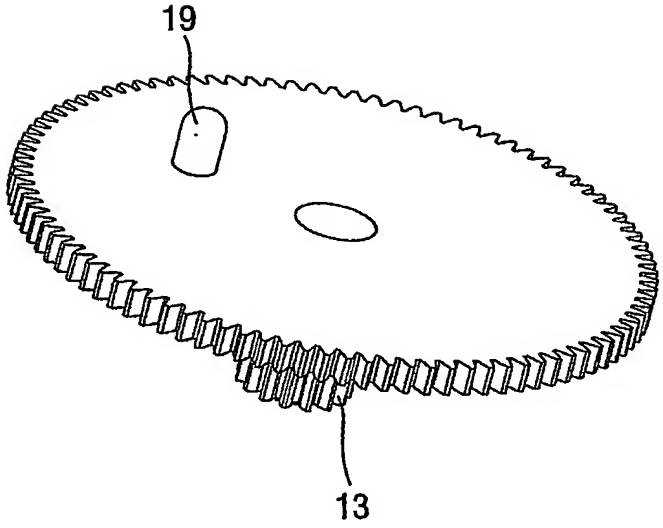

FIG.4